Operating Experience Weekly Summary 98-01

January 2 through January 8, 1998

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EVENTS

1. IDENTIFICATION OF DIESEL GENERATOR VOLTAGE PROBLEM DELAYED BY PROCEDURE DEFICIENCY

On January 5, 1998, at the Savannah River Site, a surveillance test procedure requirement to check and record equipment status 10 minutes after starting a standby diesel generator resulted in a delay in identifying a generator high-voltage condition. When the surveillance operator began recording information during load testing of the generator, he noticed the voltage indication on the diesel control panel was at 600 volts ac, rather than the nominal 480 volts. The operator notified the shift supervisor of the problem per the surveillance procedure. The shift supervisor and operator then noticed smoke exiting from the control panel. The supervisor immediately notified the fire department and shift manager, and the operator shut down the standby diesel generator. Investigators found two damaged transformers inside the control panel. Although the high-voltage condition may not have occurred at start-up, the procedure should have required immediate monitoring of diesel generator operating parameters. The procedure also should have included instructions for immediate shutdown of the diesel to prevent or minimize equipment damage when operators observed abnormal indications. (ORPS Report SR--WSRC-FTANK-1998-0002)

Control room operators initiated the emergency response procedure for a fire when the surveillance operator shut down and secured the diesel generator. Operators de-energized all normal power to the appropriate building motor control center. Firefighters did not apply extinguishing agents because the smoke stopped after electrical power to the equipment was de-energized. Inspectors found two damaged transformers during a visual inspection of the cabinet, but observed no other damage. Work planners prepared work requests to troubleshoot and repair the standby diesel generator.

The facility manager directed procedure writers to modify the surveillance procedure and provide better guidance for shutting down the diesel and checking operating parameters. Personnel will also review the procedures for three other diesel generators for possible revision before operation is resumed.

NFS has reported numerous inadequate procedure events in the Weekly Summary. These events involved procedures that (1) lacked instructions for correct equipment lineups, (2) did not include important safety warnings, (3) provided incorrect setpoints and calculations, and (4) did not adequately address operational safety requirements. Following are some examples.

- Weekly Summary 97-08 reported that process specialists at the Rocky Flats Environmental Technology Site found a valve in the wrong position while draining plutonium nitrate solution from a process tank. The valve was not identified in the procedure for draining the tank. The valve affected the sparging operation, which is a criticality evaluation-required step that is necessary to mix the solution before sampling and draining. This procedure inadequacy affected the sampling process and the movement of solutions that had criticality safety implications. (ORPS Report RFO--KHLL-771OPS-1997-0009)

- Weekly Summary 97-04 reported that a sample-aisle operator backflushed a sampler unit with 4.1 percent nitric acid instead of domestic water after sampling a vessel at the Savannah River Site. The acid and carbonate mixture reacted in the sampler lines and spread contamination onto the floor of the sampler box. The sample procedure did not specify the correct flushing solution or warn of possible chemical reactions. (ORPS Report SR--WSRC-FCAN-1997-0003)

- Weekly Summary 96-48 reported that an operator performing a valve lineup on an instrument air dryer at the West Valley Site closed a bypass valve before opening the supply air valve and caused the main plant process ventilation to shut down. The operator used the correct procedure; however, the procedure did not give a specific, sequenced valve lineup. Inadequate procedures resulted in the loss of main plant ventilation system. (ORPS Report OH-WV-WVNS-1996-0012)

These events underscore the need for procedure writers to include accurate information for the operators who rely on the procedures for guidance when operating or testing facility equipment. Although the surveillance operator who conducted the diesel generator load test correctly followed the procedure, inadequacies or weaknesses in the procedure delayed identification of an undesirable condition that required the diesel to be shut down.

DOE 5480.19, *Conduct Of Operations Requirements for DOE Facilities*, chapter XVI, "Operations Procedures," states that operations procedures provide direction to ensure that the facility is operated within its design basis. It also states that these procedures should be used effectively to support safe operation of the facility. Attention should be given to writing, reviewing, and monitoring operations and surveillance procedures to ensure the content is technically correct and the wording and format are clear. DOE-STD 1029-92, *Writers Guide For Technical Procedures*, provides guidance to assist procedure writers across the DOE complex in producing accurate, complete, and usable procedures that promote safe and efficient operation. Subject matter experts should review both new and revised procedures before issuance to ensure that the information, instructions, and cautions are technically accurate and that human-factor considerations have been included.

KEYWORDS: procedures, surveillance, diesel generator, high voltage, fire

FUNCTIONAL AREAS: Procedures, Surveillance, Operations

2. WASTE DRUMS DROPPED AT HANFORD

This week, OEAF engineers reviewed two recent events at the Hanford Site involving hoisting and rigging problems. On December 18, 1997, at the Pacific Northwest National Laboratory, facility operations personnel were lowering a 55-gallon drum containing radiological waste when the drum slipped free of its rigging and fell approximately 8 feet. A radiological control technician immediately determined that the drum was dented but not breached. There was no spread of contamination and no injuries to personnel. On November 25, 1997, at the 300 area, as riggers lowered a drum onto a trailer, the drum slipped free of its rigging and fell over. A rigger working on the trailer bed fell from the trailer and sustained a head injury. Pacific Northwest National Laboratory Environmental, Safety and Health managers are forming a working group to review hoisting and rigging practices, including the use of drum slings, and to make recommendations for long-term corrective actions. Failure to observe safe lifting practices leads to dropped loads with the potential for injuring personnel and spreading contamination. (ORPS Reports RL--PNNL-PNNLBOPEM-1997-0002, RL--PHMC-FSS-1997-0030)

During a critique for the December 18 event, investigators determined that, as the drum was being lowered, the free end of the hoisting chain caught on the drum lid closure ring bolt. The free end of the hoisting chain was moving upward, relieving the load on one of the barrel hooks of the lifting sling. The drum began to tilt, and the rigging disengaged from the drum. Investigators determined that the hoist was not equipped with a chain bucket. This would have prevented the free end of the hoist chain from coming in contact with the load, but procedures did not require a chain bucket for this operation. Investigators also determined that neither the operator nor the spotter was in continual visual contact with the load as required by applicable procedures.

During a critique for the November 25 event, investigators determined that, when riggers lowered the drum, it caught on an adjacent drum on the truck bed and momentarily relieved the load on one of the barrel hooks of the lifting sling. The hook disengaged from the drum lid closure ring, and the drum dropped to the trailer bed surface. The rigger was injured when he fell to the pavement as he attempted to jump back from the falling drum. Figure 2-1 shows the rigging arrangement used for both occurrences.

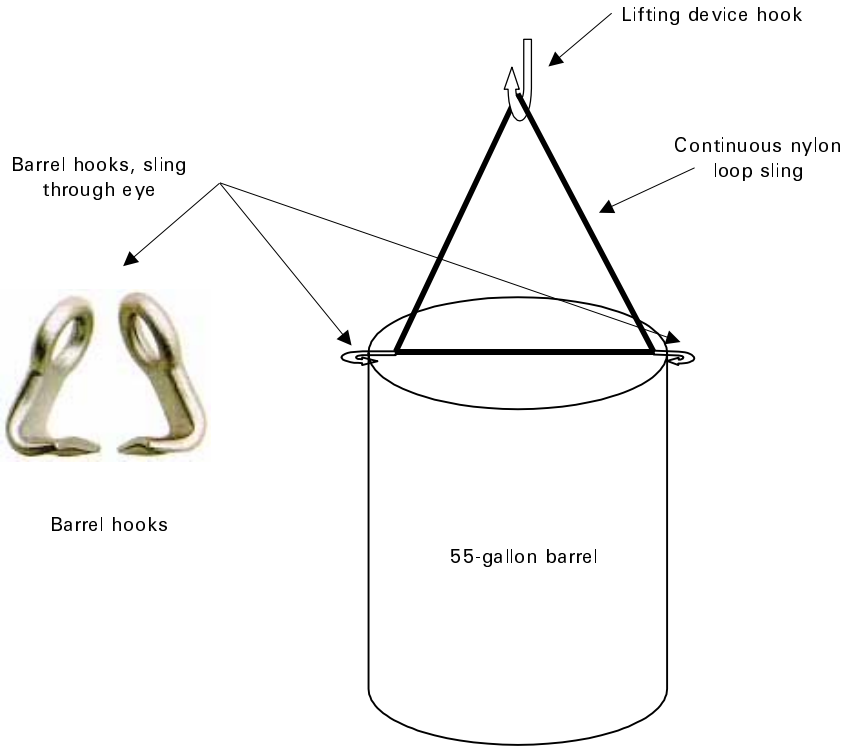

Figure 2-1. Drum Sling Rigging Arrangement

NFS has reported on events involving dropped loads in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-37 reported that a 460-pound submersible pump dropped when a 3/8-inch-diameter, carbon-steel choker broke during a lift at the Hanford N-Reactor. Investigators believe the choker, a short wire-rope sling used to form a slip noose around the object to be lifted, was weakened by corrosion and that the riggers did not inspect it before the lift. (ORPS Report RL--BHI-NREACTOR-1997-0016)

- Weekly Summary 97-29 reported that fuel-handling personnel dropped an empty fuel canister approximately 12 feet while moving it into a fuel storage area at the Idaho National Engineering Laboratory. The lifting bail of the canister was not properly engaged with the crane hook. (ORPS Report ID--LITC-FUELRCSTR-1997-0009)

- Weekly Summary 96-51 reported that a construction worker at the Pantex Plant was injured when a 250-pound steel plate knocked him from a step ladder and he fell 4 feet to the floor. Two construction workers were lifting the plate with a hand-operated chain hoist. The chain was not properly rigged, and it came loose when one of the workers shook the load to clear an obstruction. (ORPS Report ALO-AO-MHSM-PANTEX-1996-0239)

- Weekly Summary 95-34 reported that a weld stand weighing 540 pounds dropped from an overhead crane at the Oak Ridge Y-12 Site when the lifting hardware (eyebolts) failed. Investigators determined that the stand was not designed with lifting provisions and the operator-installed eyebolts were not bottomed out. The load was not balanced, and operators performed the lift with the load perpendicular to the eyebolt shank. (ORPS Report ORO--MMES-Y12NUCLEAR-1995-0015)

- Weekly Summary 92-31 reported that a worker was fatally injured at the Oak Ridge K-25 Site when a tie-down strap being used as a lifting strap failed while lifting a storage tank. (ORPS Report ORO--MMES-K25GENLAN-1992-0094)

These events illustrate the importance of observing safe hoisting and rigging practices. DOE-STD-1090-96, rev. 1, *Hoisting and Rigging*, provides guidance for hoisting and rigging and identifies related codes, standards, and regulations. Chapter 6, “Personnel Qualification and Training,” states that training for riggers should address two levels of performance: (1) persons who may perform rigging functions as an incidental part of their normal work assignment and (2) persons whose principal assignment is the performance of rigging work. Supervisors and foremen shall be familiar with applicable rules and procedures implemented at the site to ensure that hoisting and rigging work under their control is performed safely and efficiently. Chapter 14, “Below-The-Hook Lifting Devices,” discusses design and fabrication, the marking of the lifting device, inspections, and testing of the lifting device.

ASME B30.20-1993, *Below-The-Hook Lifting Devices*, chapter 20-1, applies to the classification, construction, inspection, installation, testing, maintenance, and operation of structural and mechanical lifting devices.

KEYWORDS: hoisting and rigging, dropped load, inspection, rigging

FUNCTIONAL AREAS: Hoisting and Rigging

3. EXCAVATION PERMIT VIOLATIONS

This week, OEAF engineers reviewed two recent events involving excavation permit violations. On December 29, 1997, at the Fernald Environmental Management Project, On-Site Disposal Facility personnel discovered that electricians installed four grounding rods for a construction boundary fence using a penetration permit (similar to an excavation permit) that was issued to another subcontractor to install fence posts. There were no impacts to site services as a result of this occurrence. On December 17, 1997, at the Los Alamos National Laboratory, excavation permit reviewers determined that subcontractor workers performed trenching with an improper excavation permit. The workers cut a cable, disrupting site computer services. Improper excavation can result in severe injury or death, as well as disruption of site services. (ORPS Reports OH-FN-FDF-FEMP-1997-0061, ALO-LA LANL-FIRNGHELAB-1997-0007)

During an investigation at the Fernald Environmental Management Project, electrical subcontractor representatives stated that they thought the penetration permit issued to the fence subcontractor for the installation of fence posts was adequate for them to use to install the electrical grounding rods. The electrical subcontractor installed four grounding rods at a depth of approximately 10 feet. However, on-site disposal facility personnel discovered that the permit issued to the fencing contractor limited the depth of penetrations to 5 feet and the electrical subcontractor was not included on the permit. Investigators discovered that, before performing any penetrations, the subcontractors and Fluor Daniel Fernald personnel performed a walk-down of the locations where penetrations were planned and identified all of the active underground utilities. This event is the most recent of three penetration permit violation occurrence notification reports the Fernald Environmental Management Project submitted in December 1997. The previous two reports involved deficient penetration permits for the installation of fence posts on the same project.

At the Los Alamos National Laboratory, Dynamic Experimentation Facility, excavation permit reviewers discovered that a construction subcontractor performed trenching operations using an excavation permit that was issued only for exploratory soil boring to help determine the exact location of buried utilities. Investigators later discovered that the Los Alamos National Laboratory project leader had not ensured development of the required security plan and did not coordinate with the ecology group before trenching operations began. They also discovered that the Los Alamos National Laboratory project leader gave permission for the subcontractor to proceed with trenching operations.

NFS has reported violations of excavation permits in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-44 reported three events involving inadequate work controls and pre-job planning for excavation activities. At the Hanford Site, a plant maintenance worker received a slight shock from a heat-traced line while excavating a potable water line. At the Idaho National Engineering Environmental

Laboratory, a construction worker struck and damaged an energized 480-volt cable with a backhoe, interrupting power to three buildings. At the National Institute for Petroleum and Energy Research, a construction worker severed a natural gas line with a trenching machine, resulting in evacuation of the area. (ORPS Reports RL--PHMC-KBASINS-1997-0023, ID--LITC-LANDLORD-1997-0017 and HQ--GOPE-NIPER-1997-0005)

- Weekly Summary 97-33 reported four events involving improper excavation. At Hanford, a subcontractor performing renovation activities in a building basement cut a conduit containing an energized 110-volt line. At Lawrence Livermore National Laboratory, a contractor cut an underground energized 480-volt line while using construction equipment to loosen the soil surface. At the Hanford Waste Encapsulation and Storage Facility, a back-hoe operator performing excavation activities severed an abandoned underground telephone line. When work resumed on the next day, the back-hoe operator severed an abandoned, de-energized electrical cable. (ORPS Reports RL--PHMC-WESF-1997-0007, RL--PNNL-PNNLBOPER-1997-0023, and SAN--LLNL-LLNL-1997-0051)

- Weekly Summary 96-42 reported that jackhammer operators struck three conduits while working on a concrete dock inside a building at the Rocky Flats Environmental Technology Site. The subcontractor assumed that the prime contractor had verified that no utilities were located beneath the concrete. (ORPS Report RFO--KHLL-REGWSTOPS-1996-0005)

- Weekly Summary 96-04 reported that a mason tender at Los Alamos National Laboratory received a severe electrical shock that resulted in serious burns and cardiac arrest. The mason tender was excavating in a building basement when the jackhammer he was operating contacted an energized 13.2-kV electrical cable. (Type A Accident Investigation Board Report on the January 17, 1996, Electrical Accident with Injury in Building 209, Technical Area 21 Los Alamos National Laboratory; ORPS Report ALO-LA-LANL-TSF-1996-0001)

These events underscore the importance of using effective work control practices and detailed pre-job planning. Pre-job briefings, facility procedures, and training programs should emphasize the dangers associated with excavation activities. Work packages must be detailed enough to identify permitting requirements and must clearly state who is responsible for securing permits. Following are some references that facility managers, program and project managers, and project personnel should review to ensure they are incorporated in the excavation permitting process.

- DOE/EH-0541, Safety Notice 96-06, "Underground Utilities Detection and Excavation," provides descriptions of recent events, an overview of current technology for underground utility detection, specific recommendations for improving site utilities detection and excavation programs, and information on innovative practices used at DOE facilities.

- DOE-STD-1050-93, *Guideline to Good Practices for Planning, Scheduling, and Coordination of Maintenance at DOE Nuclear Facilities*, provides information on work controls and work coordination.

- 29 CFR 1926, *Safety and Health Regulations for Construction,* paragraphs .651(b) and .416(a)(3), assign employers responsibility for identifying underground hazards and energized circuits near the work area. The requirements of 29 CFR 1926.965(c) state that work must be conducted in a manner to avoid damage to underground facilities.

Safety Notice 96-06 can be obtained by contacting the ES&H Information Center, (301) 903-0449, or by writing to ES&H Information Center, U.S. Department of Energy, EH-72/Suite 100, CXXI/3, Germantown, MD 20874. Safety Notices are also available on the OEAF Home Page at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

KEYWORDS: construction, excavation

FUNCTIONAL AREAS: Construction, Industrial Safety, Hazards Analysis, Work Planning

FINAL REPORTS

This section of the OE Weekly Summary discusses events filed as final reports in the ORPS. These events contain new or additional lessons learned that may be of interest to personnel within the DOE complex.

1. TEMPORARY POWER CABLE SEVERED

On October 30, 1997, construction workers at the Monticello Remedial Action Project repository severed a temporary, partially buried, energized 480-volt cable with a front-end loader. They severed the cable while moving a pile of sand that had been dumped in the area above the cable. The cable connected a portable diesel-driven generator, rated at 141 kilowatts, to a power distribution panel located next to a decontamination pad at the repository. Investigators reported that construction personnel originally installed the cable on top of the ground. However, because of foot and vehicular traffic over a period of several months, the cable became buried to a depth of 2 to 3 inches. Site personnel immediately stopped all work until an investigation was completed and initial corrective actions implemented. There were no personnel injuries and no equipment damage other than the severed cable. (ORPS Report ALO--MCTC-GJPOTAR-1997-0014)

Investigators determined that the cable connected a portable generator to a distribution panel used primarily to supply power to water pumps at the decontamination pad. Site personnel located the generator approximately 40 feet from the pad to minimize spraying it with water during decontamination activities. Investigators reported that workers had dumped a pile of sand in the area between the generator and the decontamination pad. Construction workers were moving the sand to another location when they severed the cable with the front-end loader. Initial corrective actions included locating, exposing, and marking all temporary power cables on the site and protecting them.

Personnel investigating the event identified several findings that contributed to the event. Following are some of these findings.

- Site personnel considered a number of electrical cables of various sizes and ratings to be “temporary”; therefore, they did not bury or place them in conduit and did not mark their locations. They considered the cable the construction workers severed to be a temporary installation.

- Construction specifications used at the site did not address the installation of temporary electrical cables.

- Over a period of several months, the cable, which was originally laid on top of the ground, became buried to a depth of 2 to 3 inches because of foot and vehicular traffic. This significantly increased the chance of contacting the cable during construction activities.

- Some subcontractor supervisory personnel were aware of the location of the cable, but they did not inform the workers assigned to move the sand pile.

- Neither the subcontractor supervisors nor the workers inspected the work site before moving the sand pile.

Investigators determined that a management problem (inadequate administrative controls) was the root cause for the event. The lack of controls led to a buried electrical cable that did not comply with the National Electric Code and OSHA regulations. The investigators also identified several corrective actions that needed to be implemented to prevent a recurrence. Following are some of the corrective actions that site personnel implemented.

- They buried all electrical cables located in areas where vehicular traffic could occur to a minimum depth of 24 inches. They also surveyed all buried cables and included them on the “as-built” drawings.

- They placed stakes at 10-foot intervals along the length of all exposed cable runs and placed signs indicating the presence of electrical cables and their path direction.

- They held mandatory safety meetings with all subcontractor personnel. At the meetings the contractor’s project manager and the DOE facility representative stressed the importance of adhering to requirements. They also reinforced site management’s emphasis on safety.

- They increased the scope of site inspections for safety and contractual requirements by including inspections for electrical safety considerations. They also increased the frequency of the inspections from once-per-shift to three times a shift.

- They revised the project health and safety plan by incorporating requirements for work around electrical installations. They also incorporated requirements for temporary electrical installations.

The use of temporary power cables during construction activities is a common practice. However, personnel must recognize that temporary situations can become long-term or permanent through the simple passage of time. This can cause a temporary installation to become out of compliance with the requirements for a permanent condition, potentially causing an unsafe environment. Therefore, it is important that procedures and practices for handling both cases be equally stringent.

National Electric Code, Article 305, *Temporary Wiring,* and 29 CFR 1926, subpart K, *Electrical,* include provisions that apply to temporary electrical power and lighting wiring methods that may be of a class less than would be required for a permanent installation at a job site. Commentary included with Article 305-2 of the 1996 National Electric Code requires that all temporary wiring methods must be approved based on criteria such as (1) length of service, (2) severity of physical abuse, (3) exposure to weather, and (4) other special requirements. 29 CFR 1926.400, *Introduction,* addresses electrical safety requirements that are necessary for the practical safeguarding of employees involved in construction work. It also includes applicable definitions. Subparts 1926.416 and 1926.417 contain information and requirements about safety-related work practices. In addition to covering the hazards arising from the use of electricity at job sites, these regulations also cover the hazards associated with accidental contact, direct or indirect, by employees with all energized lines, above or below ground, passing through or near the job site.

KEYWORDS: underground cables, construction, electrical

FUNCTIONAL AREAS: Construction, Remediation

2. WORKER PERFORMED WORK WITHOUT REQUIRED BIOASSAY

On August 8, 1997, at the Hanford Site, a facility manager reported that a worker performed radiological work without submitting a quarterly uranium bioassay as required by the radiological work permit. Facility personnel discovered that the worker did not have a quarterly bioassay when they transcribed his radiological area entry into an access control database. The worker believed he met the radiological work permit requirement because he had recently completed bioassay sampling. However, the sample was not obtained for quarterly uranium bioassay sampling. Bioassays are important to determine if workers have been exposed to undetected releases of radioactivity. (ORPS Report RL--PNNL-PNNLNUCL-1997-0010)

Investigators determined that personnel error (procedure not used or used incorrectly) was both the direct and root cause of this event. They determined that procedures require workers to read and ensure that they comply with the radiological work permit before performing work. Although the worker did read the permit, he did not verify his qualifications before performing the work. Investigators determined that the permit was a newly revised version. They also determined that the worker and his manager believed that all bioassay requirements had been met because neither were notified that additional bioassays were necessary. Investigators also determined that the only way the worker's qualifications could have been checked was by having him use the access control system to check which bioassays were necessary for the new permit. However, neither the worker nor his immediate manager had access to these bioassay records because the access control station was not staffed when the work was done.

The facility manager held a critique. Critique members determined that dosimetry personnel must be responsible for effectively communicating bioassay status to each radiological worker. They also determined that work qualifications for new or revised radiological work permits should be verified by radiological workers before beginning work. The facility manager directed dosimetry personnel to evaluate options for providing direct bioassay access status to each radiological worker and for adding bioassay qualifications to the dose status report.

Two similar events occurred at Hanford earlier in 1997. On April 7 a worker performed radiological work without a whole body count, chest counts, or urinalysis as required by the radiological work permit. Facility personnel discovered that the worker did not meet the permit requirements when they transcribed his radiological area entry into the access control database. Investigators determined that the worker read the permit before beginning work, but did not understand that he had not met the requirements. Investigators determined that this event was an isolated error. (ORPS Report RL--PNNL-PNNLBOPER-1997-0012) On July 18 another worker performed radiological work without having the required americium bioassay. Facility personnel again discovered that the worker had not met the permit requirements when they transcribed his radiological area entry into the access control database. Investigators determined that the worker read the permit before beginning work, but did not know that his previous americium bioassay had expired. The facility manager directed dosimetry personnel to evaluate options for providing direct bioassay status access to each radiological worker and to add bioassay qualifications to the dose status report by March 31, 1998. (ORPS Report RL--PNNL-PNNLNUCL-1997-0009)

OEAF engineers have reported bioassay problems in several Weekly Summaries. Following is an example from a Weekly Summary article and a related event reported to ORPS.

- Weekly Summary 97-52 reported that the Safety and Health Operations manager at the Savannah River Site reported that only 33 percent of the workers required to provide job-specific bioassays did so. Assessors identified this problem while assessing the Site Bioassay Program. The assessment was undertaken to determine if the program had problems similar to those DOE identified at the Mound Plant. Westinghouse Savannah River Company implemented three corrective actions to prevent recurrence of the problem. These corrective actions included (1) changing procedures to clarify bioassay program requirements, (2) training Radiological Control Operations first-line supervisors on their bioassay program responsibilities, and (3) studying the need to revise bioassay program requirements to enhance compliance. Westinghouse also determined that the problems concerning the job-specific bioassay program were potential Price-Anderson Amendments Act noncompliances. On December 10, they reported these problems in the Noncompliance Tracking System. (ORPS Report SR--WSRC-HPIH-1997-0002)

- OEAF engineers reviewed two occurrence reports that resulted from a May 12, 1997, DOE review of the Mound Plant bioassay program. Reviewers observed that several employees had signed radiological work permits that required bioassay analysis without submitting the required samples. Radiological health staff compared the radiological work permit rosters with a list of bioassays performed. They determined that 57 employees signed the permits but did not submit the required bioassay samples. Investigators determined the root cause of this event was inadequate administrative control. Corrective actions included establishing a clear technical basis for bioassay requirements and implementing radiological work permit control points to ensure personnel entering job-specific radiological work permit areas have the correct bioassays. (ORPS Report OH-MB-EGGM-EGGMAT04-1997-0004)

These events illustrate the importance of workers submitting the bioassay samples required by the radiological protection program. Supervisors should ensure that workers submit all bioassays required by radiological permits or procedures. Also, the appropriate personnel in internal dosimetry organizations should ensure that methods are in place to ensure traceability of bioassay samples. DOE/EH-0256T, rev 1, *Radiological Control Manual*, establishes practices for internal dosimetry and bioassays.

- Article 362, "Uranium Operations," states that, because uranium is unusual in its chemical toxicity and sometimes contains transuranic and other radionuclides, it cannot be monitored using external dosimeters and bioassay measurements are required for dose evaluations.

- Article 521, "Requirements," identifies the requirements for participation in an internal dosimetry program and for conducting bioassay monitoring.

- Article 522, "Technical Requirements for Internal Dosimetry," requires baseline bioassay monitoring, routine bioassay monitoring, and termination bioassay monitoring for termination of employment or completion of work involving the potential for internal exposure.

These events also emphasize the importance of taking timely and effective corrective actions. The August event at Hanford could have been prevented if appropriate corrective actions from the two previous events had been implemented. DOE contractors who operate nuclear facilities and fail to implement corrective actions for identified deficiencies could be subjected to Price-Anderson civil penalties under the work processes and quality improvement provisions of 10 CFR 830.120, *Quality Assurance Requirements*. These actions include Notices of Violation and, where appropriate, non-reimbursable civil penalties. The primary consideration for determining whether DOE takes enforcement action is the actual or potential safety significance of the violation, coupled with how quickly the contractor acts to identify and correct problems. DOE STD-7501-95, *Development of DOE Lessons Learned Programs*, discusses management responsibility for incorporating appropriate corrective actions in a timely manner.

KEYWORDS: bioassay, radiation protection, radiological work permit, Price-Anderson Act

FUNCTIONAL AREAS: Radiation Protection, Licensing/Compliance, Lessons Learned